OE377-26-00060
(AAON Part No. V20780)
MODGAS-XWR Controller
Technical Guide
Overview

The OE377-26-00060 MODGAS-XWR Controller (AAON Part No. V20780) is designed to be used with White Rogers valves only. It will modulate up to two (2) White Rogers gas valves to maintain a desired Discharge (Supply) Air Temperature (up to four (4) modulating gas valves may be controlled with a second MODGAS-XWR Controller configured as a slave module). The MODGAS-XWR Controller also controls the speed of the induced draft fan to maintain proper combustion in the heat exchanger. See Figure 1.

The controller can be used as a stand-alone unit or be connected to a VCM-X E-BUS Controller, VCB-X Controller, VCC-X Controller, or 12 Relay E-BUS Expansion Module using a modular cable.

The MODGAS-XWR Controller can be configured at the factory for one (1) modulating valve, two (2) modulating valves operating in a two staged configuration, two (2) modulating valves operating in a paired master/slave arrangement (both valves operate simultaneously), or two controllers may be configured to control four (4) valves, where the first controller controls two valves in a staged configuration and the secondary (slave) controller controls an additional two valves by mimicking the operation of the first (master) controller.

The MODGAS-XWR Controller can also control or effect control of additional fixed valves for additional stages of heat. When attached to one of the listed controllers, these additional stages are effected through the controller; in stand-alone mode, these additional stages can be effected by attaching a 12 Relay E-BUS Expansion Module using a modular cable.

Features

The MODGAS-XWR Controller provides the following:

- Can control two (2) Gas Valves using input from Proof of Ignition Modules
- A second MODGAS-XWR Controller can be added as a slave to allow control of 4 modulating gas valves.
- Monitors Supply Air Temperature and Supply Air Reset and modulates gas valves to maintain Setpoint
- Provides active relays to control the Fan and Heat Stages
- Contains a 2 x 8 LCD character display and 4 buttons that allow for status display, setpoint changes, and configuration changes

NOTE: The MODGAS-XWR Controller contains no user-serviceable parts. Contact qualified technical personnel if your MODGAS-XWR Controller is not operating correctly.
Important Wiring Considerations

Please read carefully and apply the following information when wiring the MODGAS-XWR Controller. The MODGAS-XWR Controller requires the following electrical connections:

1. 18 gauge minimum wire unless otherwise noted
2. 24 VAC power connection with an appropriate VA rating
3. Supply Air Temperature Sensor and Heat Enable must have 24 gauge minimum wire
4. All 24 VAC wiring must be connected so that all ground wires remain common. Failure to follow this procedure can result in damage to the module and connected devices
5. All wiring is to be in accordance with local and national electrical codes and specifications
6. Check all wiring leads at the terminal block for tightness. Be sure that wire strands do not stick out and touch adjacent terminals. Confirm that all transducers required for your system are mounted in the appropriate location and wired into the correct terminals

WARNING: Observe polarity! All boards must be wired GND-to-GND and 24 VAC-to-VAC. Failure to observe polarity could result in damage to the board.
Single Modulating Valve No Staging - Stand-Alone Wiring

This configuration operates as Stand-Alone (Figure 2, below) or communicating with an AAON Unit Controller (Figure 8, page 11).

If using an MHGRV-X Controller along with the MODGAS-XWR Controller in Stand-Alone, the SAT Sensor always attaches to the MODGAS-XWR Controller.

Figure 2: Single Modulating Valve No Staging Stand-Alone Wiring Diagram
One Modulating Valve & 1 Fixed Heat Stage Stand-Alone Wiring

This configuration operates as Stand-Alone (Figure 3, below) or communicating with an AAON Unit Controller (Figure 9, page 12).

If using an MHGRV-X Controller along with the MODGAS-XWR Controller, the SAT Sensor always attaches to the MODGAS-XWR Controller.

The fixed stage uses the Heat Enable (H2) relay to enable it (Figure 3, below).

**NOTE:** Up to 12 additional fixed stages can be added by using the 12-Relay E-BUS Expansion Module. (Figure 7, page 10).

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**Figure 3: Single Modulating Valve & 1 Fixed Stage - Stand-Alone**

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**MODGAS-XWR CONTROLLER (OE377-26-00060)**

- Connect SAT Input to Reheat Board’s SAT Input if Applicable.
- See Table 7, Page 30.

**Check Your Fan Relay Wiring (RLY1) Schematic For Proper Wiring.**

**See Table 8, Page 30**

For SAT OPTIONS Jumper Settings Only One Supply Air Temperature Sensor Can Be Used Per Application.

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1) 24 VAC Must Be Connected So That All Ground Wires Remain Common.

2) All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.
Two Modulating Valves Staged - Stand-Alone Wiring

This configuration operates as Stand-Alone (Figure 4, below) or communicating with an AAON Unit Controller (Figure 10, page 13).

If using an MHGRV-X Controller along with the MODGAS-XWR Controller in Stand-Alone, the SAT Sensor always attaches to the MODGAS-XWR Controller.

Figure 4: Two Modulating Valves Staged Stand-Alone Wiring Diagram
Two Modulating Valves Master/Slave - Stand-Alone Wiring

This configuration operates as Stand-Alone (Figure 5, below) or communicating with an AAON Unit Controller (Figure 11, page 14).

If using an MHGRV-X Controller along with the MODGAS-XWR Controller in Stand-Alone, the SAT Sensor always attaches to the MODGAS-XWR Controller.

NOTE: Up to 12 fixed stages can be added by using the 12-Relay E-BUS Expansion Module. The stages start with 2 (the numbers in parentheses). (Figure 7, page 10).

Figure 5: Two Modulating Valves Master/Slave Stand-Alone Wiring Diagram
Four Modulating Valves Master/Slave - Stand-Alone Wiring

In this configuration, the Two Modulating Valves Master/Slave wiring on the facing page is the Master portion and Figure 6, below is the Slave portion, thus creating four modulating valves.

This configuration operates as Stand-Alone (Figure 6, below) or communicating with an AAON Unit Controller (Figure 12, page 15).

If using an MHGRV-X Controller along with the MODGAS-XWR Controller in Stand-Alone, the SAT Sensor always attaches to the MODGAS-XWR Controller.

Figure 6: Four Modulating Valves Slave Portion - Stand-Alone Wiring Diagram
One Modulating Valve with 1 Fixed Stage or Two Modulating Valves - Stand-Alone Wiring, Continued

The 12-Relay E-BUS Expansion Module is only used with Single Modulating Valve One Fixed Stage Stand-Alone (Figure 3, page 6), Two Modulating Valves Stand-Alone (Figure 4, page 7), Two Modulating Valves Master/Slave (Figure 5, page 8), or Four Modulating Valves Master/Slave (Figure 6, page 9) configurations. See Figure 7, below.

If communication is lost to the 12-Relay E-BUS Expansion Module, the 12-Relay E-BUS Expansion Module will turn off its relays and the MODGAS-XWR Controller will alarm and fall back to using only its onboard stages. If communications is restored, the MODGAS-XWR Controller will begin staging up if needed.

WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

*Note for numbers in parentheses: Staged numbers start at 2 when used with the Two Modulating Valves Master/Slave - Stand-Alone Wiring configuration.

Figure 7: Stand-Alone Up to 12 Additional Stages of Fixed Heat - 12-Relay E-BUS Expansion Module
Single Modulating Valve No Staging - Communicating Wiring

This configuration operates as Stand-Alone (Figure 2, page 5) or communicating with an AAON Unit Controller (Figure 8, below).

For VCM-X Controllers, use an I2C Cable connecting to the appropriate I2C port on the controller.

For all other controllers, use an E-BUS cable connecting to an E-BUS port on the controller.

Figure 8: Single Modulating Valve No Staging Communicating Wiring Diagram
**WIRING**

**Single Modulating Valve & 1 Fixed Stage - Communicating Wiring**

This configuration operates as Stand-Alone (Figure 3, page 6) or communicating with an AAON Unit Controller (Figure 9, below).

For VCM-X Controllers, use an FC Cable connecting to the appropriate FC port on the controller.

For all other controllers, use an E-BUS cable connecting to an E-BUS port on the controller.

**NOTE:** If additional fixed stages are required, these should be configured and wired to the AAON Unit Controller’s relays.

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**Figure 9: Single Modulating Valve & 1 Fixed Stage Communicating Wiring Diagram**
Two Modulating Valves Staged - Communicating Wiring

This configuration operates as Stand-Alone (Figure 4, page 7) or communicating with an AAON Unit Controller (Figure 10, below).

For VCM-X Controllers, use an FC Cable connecting to the appropriate FC port on the controller.

For all other controllers, use an E-BUS cable connecting to an E-BUS port on the controller.

NOTE: If additional fixed stages are required, these should be configured and wired to the AAON Unit Controller’s relays.

The SAT OPTIONS Jumper Setting Should Be Set to 1. See Table 9, Page 30 For Settings. Only One Supply Air Temperature Sensor Can Be Used Per Application.

1) 24 VAC Must Be Connected So That All Ground Wires Remain Common.
2) All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.

Figure 10: Two Modulating Valves Staged Communicating Wiring Diagram
Two Modulating Valves Master/Slave - Communicating Wiring

This configuration operates as Stand-Alone (Figure 5, page 8) or communicating with an AAON Unit Controller (Figure 11, below).

For VCM-X Controllers, use an FC Cable connecting to the appropriate FC port on the controller.

For all other controllers, use an E-BUS cable connecting to an E-BUS port on the controller.

NOTE: If additional fixed stages are required, these should be configured and wired to the AAON Unit Controller’s relays.

1) 24 VAC Must Be Connected So That All Ground Wires Remain Common.
2) All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.

Figure 11: Two Modulating Valves Master/Slave Communication Wiring Diagram
**Four Modulating Valves Master/Slave - Communication Wiring**

This configuration operates as Stand-Alone (Figure 6, page 9) or communicating with an AAON Unit Controller (Figure 12, below).

In this configuration, the Two Modulating Valves Master/Slave wiring in Figure 11, page 14 is the Master portion and Figure 12 below is the Slave portion, thus creating four modulating valves.

**NOTE:** The Four Modulating Valves Master/Slave configuration is not supported when using I2C communications.
**Inputs and Outputs**

**I/O Map**

The following inputs and outputs are available on the MODGAS-XWR Controller. See Table 1 below to reference the Input/Output Map.

<table>
<thead>
<tr>
<th>Analog Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reset Signal (RST IN)</td>
</tr>
<tr>
<td>2. Supply Temperature (SAT)</td>
</tr>
<tr>
<td>3. (AUX AIN) - Not Used</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Binary Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (AUX BIN) - Not Used</td>
</tr>
<tr>
<td>2. Heat Enable (HEAT EN)</td>
</tr>
<tr>
<td>3. Proof of Ignition 1 (PO-IGN1)</td>
</tr>
<tr>
<td>4. Proof of Ignition 2 (PO-IGN2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communicating Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gas Valve 1</td>
</tr>
<tr>
<td>2. Gas Valve 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relays</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fan (RLY1)</td>
</tr>
<tr>
<td>2. Low Speed Fan (RLY2)</td>
</tr>
<tr>
<td>3. Heat 1 (RLY3)</td>
</tr>
<tr>
<td>4. Heat 2 (RLY4)</td>
</tr>
</tbody>
</table>

Table 1: MODGAS-XWR Controller Inputs & Outputs

**Analog Inputs**

**Reset Input (RST IN)**

Used only in stand-alone operation. The Discharge Temperature Setpoint can be reset by supplying a 0-10 VDC signal to the RST IN low voltage terminal block. This reset signal is optional and need only be used if you require resetting of the discharge air temperature.

**Supply Air Temperature Sensor (SAT)**

Used only in stand-alone operation. The Supply Air Temperature Sensor is the control source. This sensor has to be installed for the unit to operate. The Supply Air Sensor is located in the discharge air stream and monitors discharge air temperature to maintain the discharge air temperature setpoint.

**Binary Inputs**

**Heat Enable Contact (HEAT EN)**

This input is only required when the controller is used in stand-alone operation; it is not required when used as an expansion board to other unit controllers. The Heat Enable input is activated by a 24VAC signal supplied from a building automation system to enable the MODGAS-XWR Controller. The controller will not operate without 24VAC being applied to this input terminal when used in a stand-alone configuration.

**Proof of Ignition 1 (PO-IGN1)**

The Proof of Ignition input is activated by a 24VAC signal supplied from the Ignition Module to enable the modulating Gas Valve 1. If the flame does not ignite, the Ignition Module will turn off this enable. The MODGAS-XWR Controller will then turn on the “No Proof of Flame” alarm.

**Proof of Ignition 2 (PO-IGN2)**

The Proof of Ignition input is activated by a 24VAC signal supplied from the Ignition Module to enable the modulating Gas Valve 2. If the flame does not ignite, the Ignition Module will turn off this enable. The MODGAS-XWR Controller will then turn on the “No Proof of Flame” alarm.

**Communicating Outputs**

**Gas Valve Output 1**

This communicating output will control the modulating gas valve. It can detect if the valve is connected and can verify the valve position.

**Gas Valve Output 2**

This communicating output will control the modulating gas valve. It can detect if the valve is connected and can verify the valve position.

**Relay Outputs**

**Relay #1 - Fan Enable**

This relay works in conjunction with the Low Speed Fan Relay to control the speed of the induced draft blower motor. When the MODGAS-XWR Controller has heat enabled, this relay closes to bring the induced draft blower on at high speed. The controller will activate the Low Speed Fan Relay to reduce the induced draft blower speed as the gas valve modulates closed.

**Relay #2 - Low Speed Fan**

Depending on the gas valve position, this relay will close to switch the induced draft blower to low speed. The controller automatically switches the blower to low speed as the gas valve modulates closed in order to maintain proper fuel to air ratios.

**Relay #3 - Heat 1**

Once the MODGAS-XWR Controller brings on heat, Heat 1 Relay is the first stage of heat.

**Relay #4 - Heat 2**

Once the MODGAS-XWR Controller brings on heat, Heat 2 Relay is the second stage of heat if the MODGAS-XWR is configured for two stages of heat.
**Operation Modes**

The MODGAS-XWR Controller can be used stand-alone or connected to a Main Controller using a modular cable.

**Stand Alone Mode**

When used in a stand-alone application (not connected to a Main Controller via a modular cable), the MODGAS-XWR Controller will modulate the gas valve(s) to maintain the DISCHARGE setpoint configured on the MODGAS-XWR Controller LCD display. The MODGAS-XWR Controller is activated by a 24VAC signal to the HEAT EN input.

The following describes the setpoints available in stand-alone mode for adjustment using the LCD display on the MODGAS-XWR Controller:

- **Supply Air Temperature Setpoint**
- **Supply Air Reset Temperature Setpoint**

**Communicating Mode**

When the MODGAS-XWR Controller is connected to a Main Controller via a modular cable, the necessary information will be passed between the MODGAS-XWR and the Main Controller to properly operate in the Heating Mode.

If the communication is interrupted between the MODGAS-XWR Controller and the Main Controller, both boards will show an alarm. When communication is restored, the alarms will go away.

In this configuration, the Supply Air Temperature Setpoint is set using the Main Controller and the Supply Air Temperature Reset (if used) is calculated by the Main Controller. The Supply Air Temperature is sent to the MODGAS-XWR from the Main Controller.

**MODGAS-XWR Staging Configurations**

The MODGAS-XWR can be configured for various Staged Heat configurations. These configurations can be used in conjunction with the VCM-X Controller, VCB-X Controller, VCC-X Controller, or 12 Relay Expansion Module.

**MODGAS-XWR Stand-Alone Configuration**

The first configuration screen allows selection of the Total Stages, which is the number of Heat Stages installed in the unit (note that if there are two heat units to be operated in a master/slave arrangement, this is considered 1 stage of heat). The next configuration screen selects the total number of Modulating Stages (White Rodgers valves), there must be at least one and cannot be more than two (if there are two modulating valves intended to be operated in master/slave, the Modulating Stages must be set as 1 and if there are four modulating valves, which must be operated as master/slave, the Modulating Stages must be set as 2).

The options for Stand-Alone operation without additional expansion boards are (1) One modulating, (2) One modulating and one fixed, (3) Two modulating, (4) Two modulating as a master/slave pair and (5) four modulating as master/slave pairs - this configuration requires two MODGAS-XWR Controllers.

**MODGAS-XWR Stand-Alone with 12-Relay E-BUS Expansion Module**

If the total number of heat stages exceeds two in stand-alone operation (one if operating in Two Modulating Valves Master/Slave), then a 12 Relay E-BUS Expansion Module is needed for the additional stages. The configuration is identical to that of the previous stand-alone, except that the total number of heat stages can be more than 2 (more than 1 for two valve master/slave). There can be up to 14 total stages (13 in two valve master/slave) in this configuration.

The options for stand-alone with 12 relay expansion are (1) one modulating with up to 13 fixed stages, (2) Two modulating with up to 12 fixed stages, (3) two modulating in master/slave arrangement with up to 12 fixed stages and (4) four modulating as two staged pairs with up to 12 fixed stages.

In order for the MODGAS-XWR to communicate properly to the 12 Relay Expansion Module, “S/A MODE” needs to be configured to “FORCED”. This configuration will make the MODGAS-XWR initiate communications with the 12 Relay Expansion Module through the E-BUS cable.

**MODGAS-XWR Communicating with AAON Unit Controller**

The first configuration screen allows selection of the Total Stages, which is the number of Heat Stages installed in the unit (note that if there are two heat units to be operated in a master/slave arrangement, this is considered 1 stage of heat). The next configuration screen selects the total number of Modulating Stages (White Rodgers valves), there must be at least one and cannot be more than two (if there are two modulating valves intended to be operated in master/slave, the Modulating Stages must be set as 1 and if there are four modulating valves, which must be operated as master/slave, the Modulating Stages must be set as 2).

If more stages of heat are needed besides the MODGAS-XWR and the main control board’s configurable relays, a 12 Relay E-BUS Expansion Module or an additional expansion board can be connected and heat stages can be configured from the main control board.

The options for Communicating operation without additional expansion boards are (1) One modulating, (2) One modulating and one fixed, (3) Two modulating, (4) Two modulating as a master/slave pair and (5) four modulating as master/slave pairs - this configuration requires two MODGAS-XWR Controllers.

**Note:** The Four Modulating Valves Master/Slave configuration is not supported when using I_2C communications.

The status screen displaying the stage status will show the current heat stage of all heat stages on the unit. For example, if two stages are active on the MODGAS-XWR and two stages are active on the main control board, the current heat stage displayed with show HEAT STAGE 4.
Navigation Keys

LCD Display Screen & Navigation Keys

The MODGAS-XWR Controller allows you to make configuration changes, view status, change setpoints, create force modes, and perform diagnostics using the keypad next to the LCD display. See Figure 13 and refer to Table 2 for descriptions.

![Figure 13: LCD Display and Navigation Keys](image)

<table>
<thead>
<tr>
<th>NAVIGATION KEY</th>
<th>KEY FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MENU</td>
<td>Use the MENU key to navigate through the Main Menu Screens.</td>
</tr>
<tr>
<td>M</td>
<td>Use this key to adjust setpoints and change configurations. This key is also used to turn Valve Force Mode on.</td>
</tr>
<tr>
<td>UP</td>
<td>Use this key to adjust setpoints and change configurations. This key is also used to turn Valve Force Mode off.</td>
</tr>
<tr>
<td>DOWN</td>
<td>Use the Enter key to move through screens within Main Menu categories. Also, use this key to save setpoints and configuration changes.</td>
</tr>
</tbody>
</table>

Table 2: Navigation Key Functions

Main Screens Map

Refer to the following map when navigating through the LCD Main Screens. The first screen is an initialization screen. To scroll through the rest of the screens, press the `<MENU>` button.

- **MODGAS STARTUP!**
- **MODGAS STEPPER**
- **STATUS SCREEN**
- **ALARMS**
- **SETPOINT**
- **FORCE VALVES**

Press 🔄 to scroll through MODGAS Screens.
Press M to go to STATUS Screens.
Press 🔄 to scroll through STATUS Screens.
Press M to go to ARMS Screens.
Press M to go to SETPOINT Screens.
Press M to go to FORCE Screens.
Press 🔄 to scroll through FORCE Screens.
Protected Screens Map

Refer to the following map when navigating through the LCD Protected Screens. From the MODGAS STEPPER Screen, press the <ENTER> twice until you get to the SOFTWARE Screen. Then hold the <UP> button for 5 seconds. To scroll through the rest of the screens, press the <MENU> button.

Main MODGAS Screens

Refer to the following map when navigating through the Main Screens. From the MODGAS Stepper Screen, press <ENTER> to scroll through the screens.

In Stand-Alone Mode, the screen will only display S/A MODE.

In Communications Mode, the screen will display COMM MODE and the items below will scroll through the screen:

1. Number of good packets being received. This will roll over after 9999. Example: +XXXX

2. Number of checksum errors. This will stop at 9999. Example: C-XXXX

3. Number of packet length errors. This will stop at 9999 until power is cycled. Example: P-XXXX

CURRENT BOARD ADDRESS
Number in parentheses is E-BUS address.

CURRENT SOFTWARE VERSION
You can access the protected screens from this screen by holding the <UP> button for 5 seconds.

# STAGES
T=2 M=2

NUMBER OF STAGES CONFIGURED
T = Total stages fixed and modulating
M = Total modulating stages
Status Screens

Refer to the following map when navigating through the Status Screens. From the STATUS Screen, press <ENTER> to scroll through the screens.

Status Screens shown below will scroll automatically if LCD display is left on this screen for 20 seconds.

This screen displays the current mode of operation of the MODGAS-XWR Controller. The mode options are:

OFF: This mode will display when there is no call for heat and heating has been disabled.

IGNITION: Each time Heat is activated, the unit will first go into Ignition Mode. During this mode, the unit will remain at maximum fire. The unit will leave this mode once proof of fire has been established. Proof of fire is established when the SAT rises 5 degrees.

HEAT: After Ignition Mode, the unit will enter the Heat Mode and will begin to modulate the gas valve to maintain the Heating Supply Air Setpoint (SAT). Once the call for heat goes away, the unit will leave the Heat Mode.

CUTOFF: The Cutoff Mode occurs if the SAT rises above 200°F. During Cutoff Mode, the Heat will be disabled for a fixed delay period. If the SAT falls below 200°F and the delay period has expired, the unit will re-enter the Heat Mode.

FORCE: The Force Mode occurs when Force Mode is manually turned on in the Force Mode screens. When you turn the Force Mode back off or after 1 hour has elapsed, the valve will reinitialize to zero.

SAT FAIL: The SAT FAIL Mode occurs if the Supply Air Temperature sensor has been disconnected for more than 60 seconds. During SAT Fail Mode, the Heat will be disabled until the Sensor is reconnected or detected.

SUPPLY AIR TEMPERATURE
40°F to 150°F or 4°C to 65°C.
If no sensor is detected, screen will display "NO SENSR"

ACTIVE SUPPLY AIR SETPOINT
Calculated from SAT Setpoint and Reset Setpoint in stand-alone mode.
In communicating mode, the Main Controller sends the setpoint.
The SAT Setpoint is set by the LCD Display in stand-alone mode and is set by the Main Controller in communicating mode.
Alarm Screens

Refer to the following map when viewing Alarm Screens. These screens will display automatically when alarms are present. For more information, see pages 20-22.

The alarms are as follows:

**NO ALARMS:** This will be shown if there are no current alarms.

**V1 NOT DETECTED:** Gas Valve 1 is not detected.

**V2 NOT DETECTED:** Gas Valve 2 is not detected.

**V1 NO PO FLAME:** No Proof of Flame Ignition Module input is detected.

**V2 NO PO FLAME:** No Proof of Flame Ignition Module input is detected.

**SAT CUTOFF:** This indicates a Supply Air Temperature Cutoff Alarm condition which is activated if the SAT has risen above 200°F. The alarm will go away if after a fixed delay period the SAT has dropped below 200°F.

**SAT FAIL ERROR:** The Supply Air Temperature sensor has been disconnected for more than 60 seconds. This alarm will be disabled when the sensor is reconnected.

**COM T/O ERROR:** Communications have been lost with the main controller. This alarm will disable when communications resume.

Setpoint Screens

Refer to the following map when navigating through the Setpoint Screens. From the SETPOINT Screen, press **<ENTER>** to scroll through the screens and change setpoints. Use the **<UP>** and **<DOWN>** arrow keys to change your selections. Then press **<ENTER>** to save the new setpoint.

**WARNING:** The **<ENTER>** key must be pressed after changing setpoints for your entries to be saved for subsequent power-ups.

**NOTE:** When the MODGAS-XWR is operating in Communications Mode, these setpoints screens will not appear on the LCD display because they are controlled by the Main Controller.

### HEATING SUPPLY AIR TEMPERATURE SETPOINT

This is the target temperature while the heating is enabled. If you are using the reset signal, this is the setpoint it will calculate to at zero volts. The Setpoint Screen will display only in stand-alone mode.

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Default</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>40°F</td>
<td>120°F</td>
<td>200°F</td>
</tr>
<tr>
<td>5°C</td>
<td>49°C</td>
<td>93°C</td>
</tr>
</tbody>
</table>

### RESET HEATING SUPPLY AIR SETPOINT

This is maximum temperature at which the Supply Air Temperature will reset to. The Setpoint Screen will display only in stand-alone mode.

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Default</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>40°F</td>
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<td>200°F</td>
</tr>
<tr>
<td>5°C</td>
<td>49°C</td>
<td>93°C</td>
</tr>
</tbody>
</table>
**Force Valve Screens**

Refer to the following map when navigating through the Force Valve Screens. From the FORCE VALVE Screen, press **<ENTER>**. At the V1 and V2 FORCE ON/OFF screens, press the **<UP>** arrow key to turn the FORCE MODE on and press the **<DOWN>** arrow key to turn the FORCE MODE off. Use the **<UP>** and **<DOWN>** arrow keys to increase and decrease the percentage.

**NOTE:** When you turn the Force Mode back off or after 1 hour has elapsed, the valve will reinitialize to zero.

**V1 FORCE ON/OFF**

Press the **<UP>** button to turn the Force Mode on. Press the **<DOWN>** button to turn the Force Mode off.

**FORCE VALVE 1 PERCENTAGE**

This screen only appears when Valve 1 Force is on.

Press the **<UP>** button to increase the percentage. Press the **<DOWN>** button to decrease the percentage.

**NOTE:** When you turn the Force Mode back off or after 1 hour has elapsed, the valve will reinitialize to zero.

**V2 FORCE ON/OFF/DISABLED**

Press the **<UP>** button to turn the Force Mode on. Press the **<DOWN>** button to turn the Force Mode off. If the screen says disabled, on/off selection is not possible.

**FORCE VALVE 2 PERCENTAGE**

This screen only appears when Valve 2 Force is on.

Press the **<UP>** button to increase the percentage. Press the **<DOWN>** button to decrease the percentage.

**Configuration Screens**

Refer to the following map when navigating through the Configuration Screens. From the CONFIG Screen, press **<ENTER>** to scroll through the screens and change setpoints. Use the **<UP>** and **<DOWN>** arrow keys to change your selections. Press **<ENTER>** to save any changes.

**NUMBER OF TOTAL STAGES**

Range is 1 to 15. Default is 2.

**NUMBER OF MODULATING STAGES**

Range is 1 or 2. Default is 2.
Configuration & Diagnostic Screens

STAGE UP DELAY
Range is 1 to 10 minutes. Default is 3.

STAGE DOWN DELAY
Range is 1 or 10 minutes. Default is 1.

IGNITION HOLD DELAY
Range is 5-120 seconds. Default is 20.

TEMPERATURE SCALE
Fahrenheit (default) or Celsius (Used in stand-alone mode only).

STAND ALONE MODE
Auto-detect or Locked. Default is Auto-detect.

START POSITION
Range is 60-100% in 5% steps. Default is 70%.

SLAVE VALVE & SLAVE MODE
Enabled or Disabled.

Diagnostic Screens

Refer to the following map when navigating through the Diagnostic Screens. From the DIAGNSTC Screen, press <ENTER> to scroll through the screens.

DIAGNSTC

WATCH DOG TIMER
Displays the number of times the board has been reset due to watchdog timer overflow.

POWER LOSS COUNT
Displays the number of times the board has been reset due to power loss.

VALVE 1 & 2 COMMUNICATION (two screens)
Displays the number of received PWM communication error signals from Valve 1 & 2. Not necessarily failed communications.
LED Diagnostics

The MODGAS-XWR Controller is equipped with LEDs that can be used to verify operation and perform troubleshooting. There are LEDs for communication, operation modes, and diagnostic codes. The module has 14 LEDs—12 used for operation & status, and 2 used for alarms.

See Figure 14 for the LED locations. The LEDs associated with these inputs and outputs allow you to see what is active without using a voltmeter. The LEDs and their uses are as follows:

**Operation LEDs**

**POWER** - This green LED will light up to indicate that 24 V AC power has been applied to the controller.

**STATUS** - This green LED will light up and blink the board address at startup. It will then blink every 10 seconds according to what mode the controller is in. See Table 3.

<table>
<thead>
<tr>
<th>No. of Blinks</th>
<th>STATUS LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Off Mode</td>
</tr>
<tr>
<td>2</td>
<td>Heating Mode (Heat Enable Signal and No Alarms)</td>
</tr>
<tr>
<td>3</td>
<td>SAT Fail Mode</td>
</tr>
<tr>
<td>4</td>
<td>SAT Cutoff Mode</td>
</tr>
</tbody>
</table>

**Table 3: STATUS LED Blink Codes**

**Diagnostic LEDs**

**ALARM** - This red LED located on the MODGAS-X Controller’s cover above the LCD display will light up to indicate an alarm. The type of alarm(s) will be shown on the LCD display. The ALARM LED also blinks when the expansion valve is initializing at startup.

The ALARM LED on the MODGAS-X board will blink an alarm code every 10 seconds when an alarm(s) occurs. The highest priority failure code will be indicated first. You must correct the highest priority alarm before other problems will be indicated. See Table 4.

<table>
<thead>
<tr>
<th>No. of Blinks</th>
<th>ALARM LED (Blinks every 10 seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Valve 1 Not Detected</td>
</tr>
<tr>
<td>2</td>
<td>Valve 2 Not Detected</td>
</tr>
<tr>
<td>3</td>
<td>Valve 1 Proof of Flame Failure</td>
</tr>
<tr>
<td>4</td>
<td>Valve 2 Proof of Flame Failure</td>
</tr>
<tr>
<td>5</td>
<td>SAT Not Detected (Stand-Alone Mode)</td>
</tr>
<tr>
<td>6</td>
<td>SAT Cutoff</td>
</tr>
<tr>
<td>7</td>
<td>Communication Failure</td>
</tr>
</tbody>
</table>

**Table 4: ALARM LED Blink Codes**

**Communication LED**

**COMM** - This yellow LED will light up and blink when communications are detected.

**Relay LEDs**

**RLY1** - This green LED will light up and stay lit as long as the Fan relay is active.

**RLY2** - This green LED will light up and stay lit as long as the Low Speed Fan relay is active.

**RLY3** - This green LED will light up and stay lit as long as the Heat Enable 1 relay is active.

**RLY4** - This green LED will light up and stay lit as long as the Heat Enable 2 relay is active.

**Binary Input LEDs**

**AUX BIN** - Not Used.

**HEAT EN** - This green LED will light up when Heat Enable signal is activated.

**PO-IGN1** - This green LED will light up when the Proof of Flame input from the first Ignition Module is enabled.

**PO-IGN2** - This green LED will light up when the Proof of Flame input from the second Ignition Module is enabled.

**Analog Output LEDs**

**GAS VALVE 1** - This red LED will blink when Gas Valve 1 is modulating or commanded to modulate. LED will stay solid if valve is detected and status is good.

**GAS VALVE 2** - This red LED will light up when Gas Valve 2 is modulating or commanded to modulate. LED will stay solid if valve is detected and status is good.
Figure 14: MODGAS-XWR Controller LED Locations and Descriptions
Troubleshooting Alarms

Mechanical Failure:
- Check relay outputs on the MODGAS-XWR for 24 VAC output.
- Verify the SAT OPTIONS jumper settings on the MODGAS-XWR for Supply Air Temperature Sensor.
- Verify gas valve LED is solid. Try forcing valves (refer to Force Screens in this guide).
- Verify that the Supply Air Temperature Sensor is connected to SAT and GND on the MODGAS-XWR (stand-alone mode) or to AI2 and GND on the Main Controller (communicating mode).
- Verify Supply Air Temperature Sensor probe is mounted correctly in supply duct.
- Remove SAT and GND wiring from the MODGAS-XWR and ohm sensor out (this may indicate open or failed wiring). Refer to chart in back of this guide for readings.

Supply Air Temperature Failure:
- Verify that the Supply Air Temperature Sensor is connected to the SAT and GND on the MODGAS-XWR (stand-alone mode) or to AI2 and GND on the Main Controller (communicating mode).
- Remove SAT and GND wiring from the MODGAS-XWR and ohm sensor out (this may indicate open or failed wiring). Refer to chart in back of this guide for readings.
- Verify the SAT OPTIONS jumper settings on the MODGAS-XWR for the Supply Air Temperature Sensor.

SAT Cutoff Mode:
- Remove SAT and GND wiring from the MODGAS-XWR and ohm sensor out (this may indicate open or failed wiring). Refer to chart in back of guide for readings.
- With Supply Air Sensor disconnected from the MODGAS-XWR, set volt meter to DC volts and measure voltage between SAT and GND on board. Refer to chart in back of this guide for readings.
- Verify Supply Air Temperature Sensor reading in duct with 3rd party temperature testing device.

Communications Loss:
- Check COMM LED on MODGAS-XWR.
- Verify 24 VAC power to all interconnected WattMaster controllers.
- Verify E-BUS connection between the MODGAS-XWR and associated WattMaster controllers.
- In communication mode (connected to an AAON unit Controller with modular cable), confirm that Main MODGAS screens shows COMM MODE that Main Controller’s MODGAS status screen displays MODGAS-XWR’s Position %.
Other Checks

0-3.3V (SAT OPTIONS Jumper Setting 1) & 0-5V (SAT OPTIONS Jumper Setting 2) Supply Air Temperature Sensor

If you suspect the Supply Air Temperature Sensor is not reading correctly, make sure the wiring terminal connections are tight and that any wiring splices are properly connected. You can check the operation of the Supply Air Temperature Sensor by measuring the resistance or voltage using a digital multimeter. Set the meter to DC Volts. Place the positive probe on the AIN terminal and the negative probe on the GND terminal. Read the DC Volts and find that voltage in Tables 5 & 6.

Read the temperature corresponding with that voltage and determine if this is close to the actual temperature the sensor is exposed to. If the temperature from the chart is different by more than a few degrees, you probably have a defective or damaged sensor. You can also check the sensor resistance to determine correct operation. To read the resistance, set the meter to Ohms. Unplug the sensor connector from the board and measure the resistance across the disconnected wires. This resistance should match the corresponding temperature from Tables 5 & 6.

<table>
<thead>
<tr>
<th>Temperature to Resistance/Voltage Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp (°F)</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>68</td>
</tr>
<tr>
<td>69</td>
</tr>
<tr>
<td>70</td>
</tr>
<tr>
<td>71</td>
</tr>
<tr>
<td>72</td>
</tr>
<tr>
<td>73</td>
</tr>
<tr>
<td>74</td>
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<tr>
<td>75</td>
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<tr>
<td>76</td>
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<tr>
<td>77</td>
</tr>
<tr>
<td>78</td>
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<tr>
<td>80</td>
</tr>
<tr>
<td>82</td>
</tr>
<tr>
<td>84</td>
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<tr>
<td>86</td>
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<tr>
<td>88</td>
</tr>
<tr>
<td>90</td>
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<tr>
<td>95</td>
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<td>100</td>
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<tr>
<td>105</td>
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<tr>
<td>110</td>
</tr>
<tr>
<td>115</td>
</tr>
<tr>
<td>120</td>
</tr>
<tr>
<td>125</td>
</tr>
<tr>
<td>130</td>
</tr>
<tr>
<td>135</td>
</tr>
<tr>
<td>140</td>
</tr>
<tr>
<td>145</td>
</tr>
</tbody>
</table>

Table 5, continued: 0-3.3 V Temperature Sensor - Voltage & Resistance for Type III Sensors

Thermistor Sensor Testing Instructions

1.) Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered).

2.) Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the “−” (minus) lead on GND terminal and the “+” (plus) lead on the sensor input terminal being investigated.

If the voltage is above 3.3 VDC, the sensor or wiring is “open.” If the voltage is less than 0.05 VDC, the sensor or wiring is shorted.
Troubleshooting

**Thermistor Sensor Testing Instructions**

1.) Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered).

2.) Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the “-” (minus) lead on GND terminal and the “+” (plus) lead on the sensor input terminal being investigated.

*If the voltage is above 5.08 VDC, the sensor or wiring is “open.” If the voltage is less than 0.05 VDC, the sensor or wiring is shorted.*

---

**Table 6: 0-5V Temperature Sensor - Voltage & Resistance for Type III Sensors**

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>Temp (°C)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10</td>
<td>-23.3</td>
<td>93333</td>
<td>4.620</td>
</tr>
<tr>
<td>-5</td>
<td>-20.6</td>
<td>80531</td>
<td>4.550</td>
</tr>
<tr>
<td>0</td>
<td>-17.8</td>
<td>69822</td>
<td>4.474</td>
</tr>
<tr>
<td>5</td>
<td>-15.0</td>
<td>60552</td>
<td>4.390</td>
</tr>
<tr>
<td>10</td>
<td>-12.2</td>
<td>52500</td>
<td>4.297</td>
</tr>
<tr>
<td>15</td>
<td>-9.4</td>
<td>45902</td>
<td>4.200</td>
</tr>
<tr>
<td>20</td>
<td>-6.7</td>
<td>40147</td>
<td>4.095</td>
</tr>
<tr>
<td>25</td>
<td>-3.9</td>
<td>35165</td>
<td>3.982</td>
</tr>
<tr>
<td>30</td>
<td>-1.1</td>
<td>30805</td>
<td>3.862</td>
</tr>
<tr>
<td>35</td>
<td>1.6</td>
<td>27140</td>
<td>3.737</td>
</tr>
<tr>
<td>40</td>
<td>4.4</td>
<td>23874</td>
<td>3.605</td>
</tr>
<tr>
<td>45</td>
<td>7.2</td>
<td>21094</td>
<td>3.470</td>
</tr>
<tr>
<td>50</td>
<td>10.0</td>
<td>18655</td>
<td>3.330</td>
</tr>
<tr>
<td>52</td>
<td>11.1</td>
<td>17799</td>
<td>3.275</td>
</tr>
<tr>
<td>54</td>
<td>12.2</td>
<td>16956</td>
<td>3.217</td>
</tr>
<tr>
<td>56</td>
<td>13.3</td>
<td>16164</td>
<td>3.160</td>
</tr>
<tr>
<td>58</td>
<td>14.4</td>
<td>15385</td>
<td>3.100</td>
</tr>
<tr>
<td>60</td>
<td>15.6</td>
<td>14681</td>
<td>3.042</td>
</tr>
<tr>
<td>62</td>
<td>16.7</td>
<td>14014</td>
<td>2.985</td>
</tr>
<tr>
<td>64</td>
<td>17.8</td>
<td>13382</td>
<td>2.927</td>
</tr>
<tr>
<td>66</td>
<td>18.9</td>
<td>12758</td>
<td>2.867</td>
</tr>
<tr>
<td>68</td>
<td>20.0</td>
<td>12191</td>
<td>2.810</td>
</tr>
<tr>
<td>69</td>
<td>20.6</td>
<td>11906</td>
<td>2.780</td>
</tr>
<tr>
<td>70</td>
<td>21.1</td>
<td>11652</td>
<td>2.752</td>
</tr>
<tr>
<td>71</td>
<td>21.7</td>
<td>11379</td>
<td>2.722</td>
</tr>
<tr>
<td>72</td>
<td>22.2</td>
<td>11136</td>
<td>2.695</td>
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<tr>
<td>73</td>
<td>22.7</td>
<td>10878</td>
<td>2.665</td>
</tr>
<tr>
<td>74</td>
<td>23.3</td>
<td>10625</td>
<td>2.635</td>
</tr>
<tr>
<td>75</td>
<td>23.9</td>
<td>10398</td>
<td>2.607</td>
</tr>
<tr>
<td>76</td>
<td>24.4</td>
<td>10158</td>
<td>2.577</td>
</tr>
<tr>
<td>78</td>
<td>25.6</td>
<td>9711</td>
<td>2.520</td>
</tr>
<tr>
<td>80</td>
<td>27.8</td>
<td>9302</td>
<td>2.465</td>
</tr>
<tr>
<td>82</td>
<td>27.8</td>
<td>8893</td>
<td>2.407</td>
</tr>
<tr>
<td>84</td>
<td>28.9</td>
<td>8514</td>
<td>2.352</td>
</tr>
<tr>
<td>86</td>
<td>30.0</td>
<td>8153</td>
<td>2.297</td>
</tr>
<tr>
<td>88</td>
<td>31.1</td>
<td>7805</td>
<td>2.242</td>
</tr>
<tr>
<td>90</td>
<td>32.2</td>
<td>7472</td>
<td>2.187</td>
</tr>
<tr>
<td>95</td>
<td>35.0</td>
<td>6716</td>
<td>2.055</td>
</tr>
</tbody>
</table>
Mounting the Supply Air Temperature Sensor

- The Supply Air Temperature (SAT) Sensor should be located in the duct-work downstream of the unit supply air connection.
- Locate the sensor in the center of the widest part of the duct. Use the supplied template and a 5/16” drill to make a hole for the sensor.
- Install the gasket over the probe and mount securely to the duct using the supplied sheet metal screws. Be sure the gasket is compressed to provide an air tight seal.
- For best accuracy, apply insulation on the outside of the duct, over the sensor. This will help prevent thermal gradients from affecting the sensor.

**WARNING:**  Make sure your Supply Air Temperature Sensor is mounted and wired according to these instructions prior to testing the unit or else the modulating valve will not control properly and may damage your equipment.

---

**Stand-Alone Mode**

In Stand-Alone Mode, the SAT Sensor is connected to the MODGAS-X Controller. If, in Stand-Alone Mode, the MODGAS-X Controller is used in conjunction with a Stand-Alone MHGRV Controller, the SAT sensor is shared between the two controllers and always attaches to the MODGAS-X Controller.

See Table 8, page 30 for SAT Options Jumper Settings and see Figures 2-6 for wiring. See Table 7, page 30 for details about retrofit applications.

**Communication Mode**

When communicating with AAON Unit Controllers, the SAT Sensor will be connected to the Main Controller. The exception would be in retrofit applications with older controllers. See Table 9, page 30 for SAT Options Jumper Settings and see Figures 8-15 for wiring. See Table 7, page 30 for details about retrofit applications.

---

**Figure 15: Supply Air Temperature Sensor Installation**


In Stand Alone Applications And In Retrofit Applications, Connect Leads to “SAT” And “GND” On MODGAS-XWR Controller. See Table 7, Page 30.

If Using A VCM-X Or VCB-X Controller, Connect Leads To “AI2” And “GND” On Main Controller.
APPENDIX A

SAT Sensor Wiring Guide & Jumper Settings

SAT Wiring Conditions

<table>
<thead>
<tr>
<th>SAT Wiring Conditions</th>
<th>MODGAS-XWR ONLY</th>
<th>MODGAS-XWR &amp; MHGRV-X</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAND-ALONE *</td>
<td>Install Supply Air Sensor in MODGAS-XWR.</td>
<td>Install Sensor in MODGAS-XWR and daisy-chain it to the MHGRV-X. Set “SAT Options” Jumpers to “MODGAS X”. If connected to a MODGAS II Retrofit, Set “SAT Options” Jumpers to “MODGAS”.</td>
</tr>
<tr>
<td>VCM-X, SA, RNE *</td>
<td>Install Supply Air Sensor in Main Controller. Connect to Main Controller using I²C cable.</td>
<td>Install Supply Air Sensor in Main Controller. Connect to Main Controller using I²C cable.</td>
</tr>
<tr>
<td>VCM, VAV/CAV, MUA, MUA II, MUA IID *</td>
<td>Install Supply Air Sensor in MODGAS-XWR. Connect to Main Controller using I²C cable.</td>
<td>Install Supply Air Sensor in MODGAS-XWR. Connect to Main Controller using I²C cable.</td>
</tr>
</tbody>
</table>

Table 7: SAT Wiring Conditions

SAT Options Jumper Settings

Refer to Tables 8 & 9 to determine the settings. See Figure 2, page 5 for jumper locations.

<table>
<thead>
<tr>
<th>STAND-ALONE MODE SAT OPTIONS JUMPER SETTINGS*</th>
<th>COMMUNICATIONS MODE SAT OPTIONS JUMPER SETTINGS*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CONDITION</strong></td>
<td><strong>SETTING</strong></td>
</tr>
<tr>
<td>MODGAS-XWR Only</td>
<td>1</td>
</tr>
<tr>
<td>MODGAS-XWR with MHGRV-X**</td>
<td>1</td>
</tr>
<tr>
<td>MODGAS-XWR with MHGRV II***</td>
<td>2</td>
</tr>
<tr>
<td>MODGAS-XWR with MHGRV III</td>
<td>2</td>
</tr>
</tbody>
</table>
| ** For SAT Sensor testing, use Table 5, page 27 for jumper setting 1 and Table 6, page 28 for jumper setting 2. **
| ** In this situation, also set MHGRV-X SAT Option to MODGAS-X. See the MHGRV-X Technical Guide for more information. **
| ** The MHGRV II must have PU resistor installed. **

<table>
<thead>
<tr>
<th>COMMUNICATIONS MODE SAT OPTIONS JUMPER SETTINGS*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CONDITION</strong></td>
</tr>
<tr>
<td>VCM-X / RNE / SA*</td>
</tr>
<tr>
<td>VCM, MUA, MUA II, MUA IID VAV/CAV**</td>
</tr>
<tr>
<td>VCB-X / VCC-X*</td>
</tr>
</tbody>
</table>
| ** For SAT Sensor testing, use Table 5, page 27 for jumper setting 1. SAT should be connected to the Main Controller. **
| ** For SAT Sensor testing, use Table 5, page 27 for jumper setting 1. SAT should be connected to the MODGAS-XWR Controller. ** |

Table 9: Communications Mode SAT OPTIONS Jumper Settings